UNIVERSITY OF MINNESOTA

Twin Cities Campus

School of Physics and Astronomy
Institute of Technology

Tate Laboratory of Physics
116 Church Street S.E.
Minneapolis, MN 55455-0112

Office: 612-624-7375
Fax: 612-624-4578
E-mail: info@physics.umn.edu
Website: http://www.physics.umn.edu/

2020 December 03

Dr. Paul Hertz
Astrophysics Director
Science Missions Directorate
National Aeronautics and Space administration (NASA)

Dear Paul,

The NASA Astrophysics Advisory Committee (APAC) had its Fall meeting on 2020 October 19-21. Due to the continuing COVID-19 environment and related NASA operational and travel restrictions, the entire three-days of the meeting where conducted virtually using WebEx^{tm} videoconferencing technology accompanied by digital portal and chat-window related means to assist in exchanging comments. The following members of the APAC attended the meeting: Manuel Batista, Kelly Holley-Bockelman, Laura Brenneman, John Conklin (Vice Chair), Massimiliano Galeazzi, Jessica Gaskin, Hashima Hasan (APAC Executive Secretary), Ryan Hickox, Lou Strolger, Suvrath Mahadevan, Margaret Meixner, Michael Meyer, Leonidas Moustakas, Lucianne Walkowicz, and Chick Woodward (APAC Chair).

Each day, Dr. Hasan began the meeting by welcoming all the APAC members, and explaining the committee's purpose. Dr. Hasan reminded APAC members who had conflicts of interest with specific topics on the agenda that as conflicted members they were allowed to listen to the presentation but could not participate in the committee's discussion. Dr. Hasan then reviewed the Federal Advisory Committee Act (FACA) rules. Dr. Woodward then welcomed the members to the meeting, outlined the agenda, and reiterated some of the FACA and conflict of interest rules. APAC members proceeded to introduce themselves.

The APAC's focus much of the afternoon of 20 October 2020 was discussion and initial selection and drafting of the Government Performance and Results Modernization Act (GPRAMA) mandatory report for the Division. For year 2020, a new format for the reporting introduced the necessity of evaluating interdisciplinary performance goals. Hence, representatives from the Heliophysics (Michael Liemohn) and Planetary Advisory Committees (Amy Mainzer and Serina Diniega), participated in the APAC's conversation and voting.

The third day of the meeting, 21 October 2020, was primarily dedicated to a discussion of NASA workforce challenges, specifically the critical role proactive engagement of Black, Indigenous, People of Color (BIPOC) communities has for the Astrophysics Division success and the identification of systematic barriers to achieving full diversity, equity, and inclusion.

The agenda consisted of the following presentations:

- Astrophysics Division Update – Paul Hertz
- *Webb* Observatory Update – Eric Smith
- Astrophysics Cubesat Missions Update – Michael Garcia
- Halostat Update – Phil Kaaret
- Biological and Physical Sciences Division Update – Craig Kundrot
- Balloon Roadmap Update – Peter Gorham
- Astrophysics Sounding Rocket Update – Thomas Hams
- Artemis CLIPS/Astrophysics Payloads Update – David Burns
- TESS Update – Patricia Boyd
- *Gehrels* Swift Observatory Update – Brad Cenko
- Exoplanet Research Program – Pamela Marcum
- ExoPAG, COPAG, and PhysPAG reports – Michael Meyer, Margaret Meixner, Graça Rocha
- ISFM Update – Dan Evans
- Gaps RFI Update – Kartik Sheth
- State of the Profession – Chick Woodward, Paul Hertz, Kartik Sheth, Aparna Venkatesan, Marcel Agüeros, Dara Norman, and the APAC Committee

The APAC thanks all the presenters for their time and efforts to provide crisp and informative presentations.

The APAC ("the committee") has the following findings and recommendations as a result of the presentations and subsequent discussions.

STATE OF THE PROFESSION

The APAC recognizes the challenges of making NASA Astrophysics an enterprise that is reflective of the national population. Nonetheless, diversity, equity, inclusion and accessibility (DEIA) are an excellence strategy, both in terms of drawing from the largest talent pool possible, as well as fostering creative problem solving. We commend the Astrophysics Division Leadership for listening and being willing to adapt policies as the situation warrants (e.g., promptly taking corrective action when it became clear that changing from an annual call for Astrophysics Data Analysis Program [ADAP] versus every other year would disproportionately impact women researchers). It will be important to understand the magnitude of the problem which will require access to demographic data. It will also require involvement of more members of the Black, Indigenous, Persons of Color (BIPOC) community. The Astrophysics Division (APD) needs to listen to BIPOC scientists to understand the challenges they face in participating fully in NASA Space Science activities. In addition, more BIPOC scientists need to be represented in all forms of leadership and advisory committee structures. The Science Mission Directorate (SMD) Anti-Racism Action Group (ARAG) has recently formed to discuss BIPOC issues and collect concrete ideas that could help change NASA to be a more diverse and inclusive organization.

The APAC was pleased to learn that APD was conducting an internal audit of its policies. Extending such an audit to its Programs could be considered. The APAC was also pleased to learn that outside expertise would be hired to help interpret these data as well as develop an impactful action plan to make progress. In its advisory role, the APAC will welcome future reports on all these activities. The APAC would further like to receive a report on the MUREP and other similar programs to understand the impact they are having and hopefully to help assess what could be done in addition to such initiatives.

The APAC greatly appreciated all three presentations from external panelists. They were powerful and thought-provoking analyses of many issues related to the lack of diversity, equity, and inclusion in Science Technology Engineering and Mathematic (STEM) fields, and NASA Space Science in particular. Dr. Venkatesan emphasized the importance of long-term programs that will establish strong bridges for non-traditional students to pursue STEM careers. She also noted that institutions accumulate expertise and hence in practice monopolize certain types of Programs, and that it is important for these institutions to engage in diversifying their teams. Dr. Agüeros noted the past success of the NASA Jenkins Fellowship, which has been discontinued along with other similar programs, and that reintroducing similar programs will help to increase and strengthen the participation of Black students in NASA programs. Dr. Norman stated that to make progress on this cultural change astronomers need institutional change. Institutions such as NASA can harness innovation through inclusion of the diverse workforce, by providing strong incentives in its Programs for the desired diversity. Barriers can be taken down by improving access to resources, so that experience and expertise can be built up, through opportunities for networking and collaboration, enabling infrastructure, and training on platforms and tools.

A theme also recognized during the exchanges between the APAC and panelists was the ethical, cultural, and scientific challenges that expanded use of low-earth orbit (LEO) satellite constellation deployment and aggressive exploitation of the trans-lunar and lunar surface environment entails. Although there are very broad questions in this arena, APD and SMD should consider how all stakeholders from a variety of cultural perspectives are impacted as strategic science planning advances.

During the discussion, the committee noted that a number of apparently successfully NASA programs aimed at increasing diversity, equity and inclusion and accessibility (DEIA) which were cut after the Great Recession in 2008-2010, were not restarted when funding became available.

The APAC also discussed the digital divide among many BIPOC communities that is an impediment to successful and sustained engagement of these communities with NASA and APD. To address digital divide and research opportunity access across the community, the committee reflected that proposal workshops that go beyond making data and tools available should be considered. The location and timing of such proposal workshops needs to be addressed by having the NASA groups organizing these to actually engage with and visit (virtually or otherwise) the smaller institutions, to learn how they operate with the resources they have, and to pro-actively improve relationships and mutual understanding. The APAC considered this as one proactive suggestion that APD could consider among others. The committee expressed the desire to work with APD to identify creative solutions.

The committee also discussed the need to identify stakeholders who should be part of deciding the future of NASA but who are not at the table, recognizing that there is a long ramp-up process for many. An Agency commitment to long-term partnerships and relationships is essential so that inclusion has the best success trajectory. Presently there is not an obvious coordinated SMD or Agency effort in developing this. For example, at the June 2020 APAC meeting, the committee heard about the MUREP Institutional Research Opportunity (MIRO), but it seemed that this effort was not coordinated with others at NASA. The committee considered whether APD should itself collate information on the many independent efforts that exist across NASA and develop a plan that describes how each of these can be used for each step of developing improved relationships with institutions and individuals that will address our inclusion challenge.

The impact of Dual Anonymous Peer Review (DAPR) to address inequities and barriers to success in the context of DEIA was also highlighted.

The APAC also recognizes that NASA's APD is not the first entity to wrestle with these issues. Wisdom, experience, and expertise exists in many places and learning as much as possible from these sources is a first step. One example is the American Institute for Physics (AIP) - American Physical Society (APS) Team-Up report. Another resource is the American Astronomical Society (AAS) Task Force on Diversity, Equity, and Inclusion (DEI) and Astronomy Graduate Education.

Findings

The APAC commends the Astrophysics Division (APD) for prompt actions arising from findings and recommendations within the APAC's 2020 June letter report.

The NASA Science Mission Directorate (SMD) is pivoting to address inequities and barriers to full and meaningful engagement of the Black, Indigenous, People of Color community across the portfolio.

Inclusion is now a clearly stated prime NASA Agency goal.

The APAC commends SMD for commissioning a National Academy of Sciences (NAS) study to identify barriers to the next generation of mission PIs, and on establishing and supporting Anti-Racism Action and DEIA Working groups.

Scheduling future APAC meetings should include consultation with key professional societies' leadership or representatives, to ensure to the extent possible both that the meeting does not conflict with major professional meetings, and to encourage those societies to be aware of, and encourage participation in the APAC discourse.

The ongoing ADAP DAPR results analysis are of high programmatic value.

Improving NASA SMD and APD engagement with many BIPOC communities is hampered by a persistent digital divide.

Recommendations

Black, Indigenous, and People of Color (BIPOC) representation must be explicitly and deliberately brought into positions of leadership and authority at the Astrophysics Division (APD), the Science Mission Directorate (SMD) and Centers supported within the portfolio.

The APAC advises NASA APD consider incentives to investigators to diversify their teams and provide meaningful diversity plans as part of major proposals to Programs.

The APAC requests a full briefing on the optional and voluntary demographic information of proposers to APD announcement of opportunities collected by the NASA Office of the Chief Scientist at its next meeting.

The APAC looks forward to a more detailed report on the impact of the Dual Anonymous Peer Review (DAPR) process in Research Opportunities in Space and Earth Sciences (ROSES) on early career scientists, first-time proposers, first-time institutions, and any other community or demographic type information that can be legally gathered.

The APAC advises APD to publicize broadly the DAPR process and the impact of DAPR results, and these items should be included in community briefings and Town Halls.

The APAC encourages all Program Analysis Groups (PAGs) to make their Executive Committees as diverse and inclusive as possible.

The APAC intends to again feature a status of the profession session as an agenda item at its next meeting.

The APAC requests that APD and SMD undertake internal discussion to explore and understand what a stand-up of a Cultural Ethics/Protocol Office that includes BIPOC from inception might entail and report out at the next APAC status of the profession session.

ASTROPHYSICS DIVISION UPDATE

The APAC appreciated the comprehensive update on the APD provided by Dr. Paul Hertz. This report included information on the APD's fiscal year (FY) 21 budget request, which has no major changes from the FY 20 budget and program. The request would support a Webb launch in 2021, maintain the current Explorer, CubeSat, and suborbital program announcement of opportunity (AO) cadence, initiate the Pioneer class of missions, maintain the current level of community support through research, technology and laboratory astrophysics grants, and extend operating missions following the senior review 2019 recommendations. Further, pending the outcome of the Astro 2020 Decadal Survey in spring 2021, the FY21 budget request would allow for a Probe mission to be formulated as early as 2022. This budget request does terminate SOFIA and provides no funding for Roman, however. While funding for these missions could be restored by Congress, this could cause a potential loss of funding to other APD programs in a

trickle-down effect, since a continuing resolution to restore SOFIA and Roman would require a reduction of $103.2M from other programs in the FY21 planning budget.

Dr. Hertz commented on the APD's efforts to mitigate COVID-related impacts on the community due to delays and/or cancelations of programs and loss of access to facilities. In particular, all operational missions have remained status quo, all peer reviews have been made virtual, and funding bridges/extensions have been set up for ongoing grants in several cases, with the highest priority being the funding of students, postdocs and early career researchers. Of note, 15% of the FY21 research and analysis (R&A) funding for new awards will be used to cover these costs.

NASA Science is now under a single management organization for the first time in decades, with the integration of the Biological and Physical Sciences Division. This reorganization appears to be going smoothly and should facilitate cooperation for common scientific endeavors. Most mission activities continue through the COVID19 crisis, albeit at reasonable reduced efficiencies.

NASA has made a policy change in their decision process for providing contributions to partner-led missions. To summarize, proposals will no longer come from the community, but will be initiated at the Agency level. NASA would then create an AO through ROSES to solicit needed community input and involvement by US science investigators. The rationale behind this change is improving efficiency, as community-driven memoranda-of-opportunity (MoO) proposals have only very rarely been successful and did not validate the level of Agency effort applied to evaluating them.

Dr. Hertz presented information on the overall growth of R&A funding over the past decade, as well as the success of the recently implemented dual-anonymous peer reviews for several programs (e.g., NuSTAR mission, ADAP) over the past year. Per the APAC's recommendation from the summer meeting, funding for a 2021 ADAP program has been restored. Dr. Hertz also noted that the 2020 ADAP program received a record number of submitted proposals (313; selections pending).

The APAC was informed that NASA is now participating in the Israeli-led UltraSat, a wide-field UV survey and transient detection mission.

The APAC expressed concerns about the potential loss of funding in the rest of the APD portfolio if SOFIA and Roman are restored to the FY21 budget, given that no new funding is requested for these missions. The committee urged the APD to carefully consider how best to mitigate this potential impact. The APAC also noted that recent Administration policy directives may adversely impact segments of the NASA workforce. The importance of foreign students and scientists associated with US academic institutions, research institutes, and NASA Centers to advance NASA's missions, science leadership, and technology innovation interests cannot be overstated. The degradation of leadership and innovation in many strategic areas of US national interest that NASA's SMD and the APD steward in their portfolios is an undesirable outcome if workforce constraints hobble the ability to seek out the best global talent.

Findings
NASA's Astrophysics Division future planning is strong but awaits the Astro2020 Decadal results for clear direction.

The APAC commends the Astrophysics Division for efforts to sustain and protect the research initiatives and projects which support early-career, soft-money, and other vulnerable groups to mitigate impacts of COVID19 on science productivity and mission development.

Continued operations of the Hubble Space Telescope into the future will benefit the astrophysics community and have cross-disciplinary impact within the SMD. Hubble provides a means to address Strategy 1.3 in the newly released NASA Science Vision.

Access to science and community participation in the Israeli-led UltraSat mission, supported by directed funding to NASA Goddard, will enhance multi-messenger astrophysics and provide strong redundancy for ultraviolet capabilities within the Astrophysics Division portfolio.

Recommendations
The APAC requests the Astrophysics Division assess and to report out potential impacts on its mission if workforce constraints are mandated and maintained over an extended period into the future.

The APAC requests the Astrophysics Division report out the institutional demographics resulting from the latest round of SmallSat and Pioneers program selections.

The APAC strongly endorses the use of Dual Anonymous Peer Reviews (DAPR), as their effectiveness at mitigating bias without muddying the evaluation process has now been demonstrated for various types of proposal reviews. The APAC advises that the Astrophysics Theory program also be included in the DAPR without delay.

WEBB OBSERVATORY UPDATE

The APAC would like to highlight the good progress that has been made on the James Webb Space Telescope despite COVID19. The Webb status report indicated COVID19 has resulted in reduced efficiencies, resulting in a shifted launch date of October 31, 2021. However, no additional funds are needed to address this. Environmental tests have been completed for the observatory, with no incident, and Ground Segment operations preparations has begun. However, the APAC recognizes that some small technical risks still remain with the project. While most of the previously presented technical issues were addressed and corrective actions have been initiated, the Ariane 5 fairing depressurization issue still remains open and will require re-analysis of some elements of the observatory and a possible structural reinforcement in a few areas. In addition, the Webb team has identified many fasteners used within the observatory that need to be re-torqued. Their investigation indicated that the method used during installation of the fasteners was inadequate to capture the full range of running torques. An action plan was put in place to prevent future failures.

Findings
APAC applauds the continued efforts on Webb to stay on-schedule and within budget, despite COVID19 impacts to work efficiencies.

Recommendations
The APAC requests that the Astrophysics Division continue to assess and present potential impacts due to COVID19 at a future APAC meeting.

The APAC also requests information from the Webb project to determine whether mid-cycle proposals would increase the science return from the mission.

ASTROPHYSICS CUBESAT MISSIONS UPDATE

The number of Cubesat proposals submitted per year is small and the quality of the proposals has warranted support for no more than one program per year. These small numbers could make a case for having the Cubesat call every other year, though Cubesat proposals calls are part of the yearly APRA.

Findings
The Cubesat selection rate is presently modest (14%) within the Astrophysics Research and Analysis (APRA) portfolio, yet the overall merit reviews are improving as the technical sophistication of the employed technologies advances.

The success rate of this Cubesat program has remained low.

Recommendations
The APAC recommends analyzing whether Cubesat calls could be made every two years, instead of on the current yearly cycle.

The APAC recommends an assessment and reporting whether investigators might benefit from NASA management of the spacecraft buss, drawing on a common inventory of high Technical Readiness Level (TRL) commercial busses.

BIOLOGICAL AND PHYSICAL SCIENCES DIVISION UPDATE

The APAC thanks Craig Kundrot for an inspiring presentation outlining the science potential of the integration of Biological and Physical Sciences into the APD portfolio. The APAC observed that there are interesting scientific collaborations and facilities utilization with other programs and activities within the APD portfolio.

BALLOON ROADMAP UPDATE

APAC applauds the effort from the Balloon Program Analysis Group (B-PAG) for their thorough and comprehensive report that details a roadmap for the next decade of scientific ballooning. The NASA suborbital Balloon Program is an extremely successful program that facilitates science and trains students. The B-PAG findings and recommendations, if followed would significantly enhance the Balloon Program over the next decade, providing an even more robust NASA capability.

Findings

Consolidation and integration of astrophysics balloon experiment data within other NASA Astrophysics Division archives is desirable.

High-altitude ballooning supports astrophysics, earth science, solar science and space physics, and planetary science missions. However, there was no inclusion within the current draft formulation of the Balloon Roadmap of the Biological & Physical Sciences (BPS), which is now part of the NASA Science Mission Directorate.

Recommendations

The APAC requests updates on advances in aerostat technologies and other long-duration balloon projects that might enable general guest-observer science using large aperture telescopes with arcsecond pointing precisions across the electromagnetic spectrum.

The APAC recommends that the Astrophysics Division consider adding a formal process for proposing piggyback payloads, potentially across disciplines.

The APAC request a detailed presentation describing the Balloon Roadmap at its next meeting as appropriate.

ARTEMIS CLIPS/ASTROPHYSICS PAYLOADS UPDATE

The APAC thanks David Burns for his informative presentation on the Artemis Commercial Lunar Payload Services (CLPS) program, the goal of which is to facilitate access to the lunar surface for science and human exploration through commercial delivery services. The program currently has 14 companies in its catalog that can receive and respond to Task Orders from NASA, with an expected cadence of 2 task orders per year. In 2021 these Task Order deliveries will commence, with a polar delivery (2021), a non-polar delivery (2022), and the Volatiles Investigating Polar Exploration Rover (VIPER; 2023).

Starting in 2023, payloads will be populated by the Payloads and Research Investigations on the Surface of the Moon (PRISM) program, which solicits proposals annually from the community for science instrumentation optimized for particular lunar surface locations specified by the Task Orders. These can have up to a 30% international contribution. The CLPS Manifest Selection Board (CMSB) will select the delivery manifests, and includes representatives from SMD, Human Exploration and Operations Mission Directorate (HEOMD), Space Technology Mission

Directorate (STMD), Office of International and Interagency Relations (OIIR) and the CLPS project office.

Findings
The trans-lunar and lunar surface environments provide exciting new and technologically transformative opportunities for Astrophysics Division science.

Use of the electromagnetic spectrum, access to orbital platforms, and mitigation of debris clutter must be proactively managed by NASA, commercial interests, and other stakeholders to protect and enable full utilization of the lunar environment for science.

Recommendations
The APAC recommends the Astrophysics Division commence dialogues within the Science Mission Directorate and the Agency at large to ensure best-practice planetary protection protocols are developed to enable beneficial, shared-use of the lunar environment.

TESS UPDATE

APAC has no concerns with TESS. The TESS team has remained productive in processing over 9 sectors during COVID19. TESS continues to deliver on exoplanets, including the discovery of a potentially habitable planet around an M dwarf star, and a close-in planet with a radius placing on the lower edge of the so-called "hot Neptune desert". TESS is also realizing great collateral gains, as nearly half of the publications have resulted from other areas of astronomy, including detections of low-frequency gravity waves from a supergiant star, and discovery of a star being disrupted by a supermassive black hole.

Findings
The TESS mission has effectively used the Mikulski Archive for Space Telescopes (MAST) archive to maximize community utilization of its data products.

GEHRELS SWIFT OBSERVATORY UPDATE

The APAC appreciated the update on the *Gehrels* Swift Observatory mission given by Brad Cenko. Since its launch in 2004, Swift has been very successful in unlocking transient and target-of-opportunity (ToO) science from visible to X-ray wavelengths. The observatory has also provided a critical complement to higher-energy observations with, e.g., NASA's NuSTAR mission. Swift has pioneered automation and other time-domain best practices, even as it has transitioned into taking on more legacy projects in recent years. Continued operation of this observatory will provide important synergies with multi-messenger and time-domain astrophysics in the coming decade, incorporating phenomena ranging from merging black holes to exoplanet transits.

Findings
Swift, in concert with NASA's TESS, NuSTAR, and Fermi observatories has demonstrated the efficiency of multi-mission synergies to address multi-messenger astrophysics.

The Swift automated XRT products pipeline, which rapidly produces high-level science data products for analysis and publication, increases the mission's scientific timeliness and impact.

EXOPLANET RESEARCH PROGRAM UPDATE

The APAC appreciated an update on the Exoplanet Research Program (XRP). The cross-divisional collaboration, particularly in Exoplanet research, which is inherently interdisciplinary, is very welcome. The APAC was particularly pleased to hear that the highest rated proposals are funded overall without regard to divisional balance. The committee looks forward to a briefing on the success rates for the most recent call and anticipates a need for continued scrutiny as the program evolves. While success rates are not a metric of program success, rates significantly lower than other comparable programs may signal that the community is not being effectively utilized in helping NASA achieve its strategic goals (particularly in a young and more diverse field such as exoplanets). The APAC reiterated that funding for instrumentation is vital in this area and is glad that funding for this remains (currently in other programs such as Strategic Astrophysics Technology [SAT] and APRA).

Recommendation
The APAC recommends clearer communications with the community to alert them that laboratory astrophysics opportunities have been shifted to Exoplanet Research Program (XRP), while general exoplanet related hardware development remains within APRA.

The APAC desires to continue discussion with Astrophysics Division management about programmatic balance across the Exoplanet Research Program (XRP) in light of the forthcoming Decadal Survey priorities.

ExoPAG, PhysPAG, COPAG REPORTS

The APAC appreciates the cross-PAG initiatives that have begun since our last APAC meeting. These include a) improving access to NASA astrophysics projects for researchers at under-served institutions, b) assess usability/accessibility of data analysis tools and data representation, and c) coordination a of cross-cutting technology development session at the January 2021 AAS meeting.

The APAC supports the personal statement made by COPAG EC Chair, Margaret Meixner, in which she committed to uncovering and eliminating biases and structural mechanisms that have negatively impacted the lives of the Black, Indigenous, and People of Color (BIPOC). The APAC is committed to doing the same.

The APAC looks forward to reviewing any possible terms of reference for future SIGs or SAGs related to the cross-PAG activities, as well as those under discussion within the COPAG EC in the areas of Beyond the Cosmic Dawn, The Galaxy Ecosystem, and on evaluating the Decadal recommendations for cross mission synergies.

Highlights from the ExoPAG presentation include their reporting at the PSAC meeting in August and their participation in the NExSS/P/AG roundtable in October. The APAC also appreciates the ExoPAG's new Exoplanet Explorers Program focusing on professional and community development.

Findings

The PAGs are actively supporting actions leading to more inclusivity, and are working to engage diverse voices, including those at under-resourced institutions and those from of the Black, Indigenous, People of Color (BIPOC).

COVID19 impacts are affecting the completion and release of many SAG and SIG deliverables.

Recommendations

The APAC recommends the PAGS continue their cross-PAG interactions, convening joint discussions at relevant professional meetings and convening cross-PAG SAGs as appropriate.

ISFM UPDATE

The APAC appreciates the presentation by Dr. Dan Evans on the Internal Scientist Funding Model (ISFM) because it makes transparent the reasons and process for this directed funding approach. The committee supports NASA's APD and SMD intention to re-evaluate the ISFM after the Decadal Survey results are out in order to re-align internal funding to support for new projects.

GAPS RFI UPDATE

Dr. Kartik Sheth presented a summary of gaps, in five areas, between NASA programs that may cause science to slip through the cracks. The technology development gap (F2) will be addressed, in part, by a technology festival organized by NASA's Chief Technologist in early 2021.

The F3 gap concerning data science techniques and algorithms generated a lot of discussion during the meeting demonstrating the level of interest to the community. The APAC debated the merits of making public (theoretical) software developed with funds from NASA. On the one hand, early career scientists who developed the code would probably prefer having some control on its use. On the other hand, NASA funded research and its products are required to be publicly available in some form. Also, committee members argued that making the code public could benefit the developer if appropriate credit is made to the originator of the code. The timing of

when code is released was also discussed. Having preliminary code online may not benefit anyone unless there is an appropriate process to peer review the code.

The gap F4 concerns NASA's investment in ground-based efforts for mission critical work. At future townhalls, SMD plans to clarify existing opportunities and its flexibility for ground-based investments. For example, the laboratory research databases could be linked across divisions in better support of research. Along these lines, gap F5 concerns data archives and the goal to make a more holistic data archive to search all data for SMD mission results.

Findings

Careful exploration of dual-use issues is required to manage publicly curated and archived software code and other technologies developed with NASA funding-support to adhere to the intent of ITAR and EARS regulations and policies.

Recommendations

The APAC recommends the Astrophysics Division leverage cloud-computing services independently approved for NASA usage by other directorates to advance scientific computing needs of its investigators and Centers.

2020 GPRAMA REVIEW

The APAC discussed NASA's APD progress towards division science goals and advancing the state of knowledge during FY 2020 as required by the 2010 Government Performance and Results Modernization Act (GPRAMA). The interdisciplinary set of performance goals for the SMD science program seeks "advance discovery in emerging fields by identifying and exploiting interdisciplinary opportunities between traditional science disciplines SMD has traditionally operated." Specifically, in 2020 the APD was challenged to advance progress on two strategic science goals:

Multiyear Performance Goal 1.1.2: *NASA shall demonstrate progress in exploring and probing the origin, evolution, and destiny of the galaxies, stars, and planets that make up the Universe.*

Multiyear Performance Goal 1.1.4: *NASA shall demonstrate progress in discovering and studying planets around other stars.*

Furthermore, the APD contributes to the following additional performance goal, whose primary review responsibility falls under the purview of the Planetary Science Division (PSD) and Planetary Science Advisory Committee (PAC).

Multiyear Performance Goal 1.1.5: *NASA shall demonstrate progress in improving understanding of the origin and evolution of life on Earth to guide the search for life elsewhere, exploring and finding locations where life could have existed or could exist today, and exploring whether planets around other stars could harbor life.*

Examples of progress in FY2020, derived from NASA facilities and research opportunities supported by the APD were summarized in the 2020 GRPAMA report. The APAC's consensus found each accomplishment significant, and as a science portfolio they are achievements that clearly advance our state of knowledge.

Findings

The Astrophysics Division's progress towards meeting both primary performance goals in 2020 is judged to be GREEN by the Astrophysics Advisory Committee (18 affirmative votes).

Sincerely,

Dr. Charles E. Woodward,
APAC Chair (on behalf of the Committee)
Professor, Minnesota Institute of Astrophysics – University of Minnesota
woodw024@umn.edu
612-624-0254